

Claims

- [c1] 1. An article for use in a high temperature, oxidative environment, comprising:
a substrate; and
a protective layer disposed over said substrate, said protective layer comprising
at least about 60 atomic percent of a metal selected from the group consisting
of Pt, Pd, Rh, Os, Ir, and mixtures thereof.
- [c2] 2. The article of claim 1, further comprising a top layer disposed over said
protective layer, said top layer comprising a thermal barrier layer.
- [c3] 3. The article of claim 2, wherein said thermal barrier layer comprises a ceramic.
- [c4] 4. The article of claim 3, wherein said ceramic comprises yttria-stabilized
zirconia.
- [c5] 5. The article of claim 2, wherein said thermal barrier layer has a thickness of at
least about 25 microns.
- [c6] 6. The article of claim 5, wherein said thickness is in the range from about 100
microns to about 250 microns.
- [c7] 7. The article of claim 2, further comprising a diffusion barrier layer interposed
between said substrate and said protective layer.
- [c8] 8. The article of claim 7, wherein said diffusion barrier layer comprises
ruthenium.
- [c9] 9. The article of claim 7, wherein said diffusion barrier layer has a thickness in
the range from about 5 microns to about 100 microns.
- [c10] 10. The article of claim 9, wherein said thickness is in the range from about 10
microns to about 50 microns.
- [c11] 11. The article of claim 1, further comprising a diffusion barrier layer interposed
between said substrate and said protective layer.
- [c12] 12. The article of claim 11, wherein said diffusion barrier layer comprises
ruthenium.

- [c13] 13.The article of claim ~~11~~, wherein said diffusion barrier layer has a thickness in the range from about 5 microns to about 100 microns.
- [c14] 14.The article of claim ~~13~~, wherein said thickness is in the range from about 10 microns to about 50 microns.
- [c15] 15.The article of claim ~~1~~, wherein said substrate comprises a superalloy.
- [c16] 16.The article of claim ~~15~~, wherein said superalloy comprises at least one of a cobalt-based alloy, a nickel-based alloy, and an iron-based alloy.
- [c17] 17.The article of claim ~~16~~, wherein said alloy comprises one of a single crystal alloy and a directionally solidified alloy.
- [c18] 18.The article of claim ~~1~~, wherein said substrate comprises a component of a gas turbine assembly.
- [c19] 19.The article of claim ~~18~~, wherein said component comprises one of a turbine blade, a vane, and a combustor component.
- [c20] 20.The article of claim ~~1~~, wherein said protective layer comprises at least about 85 atomic percent of said metal.
- [c21] 21.The article of claim ~~1~~, wherein said protective layer has a thickness of at least about 5 microns.
- [c22] 22.The article of claim ~~21~~, wherein said thickness is in the range from about 10 microns to about 250 microns.
- [c23] 23.A component for a gas turbine assembly, comprising:
a substrate comprising one of a turbine blade, a vane, and a combustor component;
a diffusion barrier layer disposed over said substrate, said diffusion barrier layer comprising ruthenium;
a protective layer disposed over said diffusion barrier layer, said protective layer comprising at least about 60 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir, and mixtures thereof; and
a thermal barrier layer comprising yttria-stabilized zirconia disposed over said

protective layer.

[c24] 24.A component for a gas turbine assembly, comprising:
a substrate comprising one of a turbine blade, a vane, and a combustor component;
a protective layer disposed over said substrate, said protective layer comprising at least about 60 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir, and mixtures thereof; and
a thermal barrier layer comprising yttria-stabilized zirconia disposed over said protective layer.

[c25] 25.A component for a gas turbine assembly, comprising:
a substrate comprising one of a turbine blade, a vane, and a combustor component;
a diffusion barrier layer disposed over said substrate, said diffusion barrier layer comprising ruthenium; and
a protective layer disposed over said diffusion barrier layer, said protective layer comprising at least about 60 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir, and mixtures thereof.

[c26] 26.A material system for protecting an article in a high temperature, oxidative environment, said system comprising:
a protective layer, said protective layer comprising at least about 60 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir and mixtures thereof.

[c27] 27.The system of claim 26, further comprising a top layer disposed over said protective layer, said top layer comprising a thermal barrier layer.

[c28] 28.The system of claim 27, wherein said thermal barrier layer comprises a ceramic.

[c29] 29.The system of claim 28, wherein said ceramic comprises yttria-stabilized zirconia.

[c30] 30.The system of claim 27, wherein said thermal barrier layer has a thickness of

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at least about 25 microns.

- [c31] 31.The system of claim 30, wherein said thickness is in the range from about 100 microns to about 250 microns.
- [c32] 32.The system of claim 27, further comprising a diffusion barrier layer, wherein said protective layer is disposed over said diffusion barrier layer.
- [c33] 33.The system of claim 32, wherein said diffusion barrier layer comprises ruthenium.
- [c34] 34.The system of claim 32, wherein said diffusion barrier layer has a thickness in the range from about 5 microns to about 100 microns.
- [c35] 35.The system of claim 34, wherein said thickness is in the range from about 10 to 50 microns.
- [c36] 36.The system of claim 26, further comprising a diffusion barrier layer interposed between said substrate and said protective layer.
- [c37] 37.The system of claim 36, wherein said diffusion barrier layer comprises ruthenium.
- [c38] 38.The system of claim 36, wherein said diffusion barrier layer has a thickness in the range from about 5 microns to about 100 microns.
- [c39] 39.The system of claim 38, wherein said thickness is in the range from about 10 microns to about 50 microns.
- [c40] 40.The system of claim 26, wherein said protective layer comprises at least about 85 atomic percent of said at least one metal.
- [c41] 41.The system of claim 26, wherein said protective layer has a thickness of at least about 5 microns.
- [c42] 42.The system of claim 41, wherein said thickness is in the range from about 10 microns to about 250 microns.
- [c43] 43.A material system for protecting a component of a gas turbine assembly,

said system comprising:

a diffusion barrier layer comprising ruthenium;

a protective layer disposed over said diffusion barrier layer, said protective layer comprising at least about 60 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir, and mixtures thereof; and

a thermal barrier layer comprising yttria-stabilized zirconia disposed over said protective layer.

[c44] 44.A material system for protecting a component of a gas turbine assembly, said system comprising:

a protective layer comprising at least about 60 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir, and mixtures thereof; and

a thermal barrier layer comprising yttria-stabilized zirconia disposed over said protective layer.

[c45] 45.A method for manufacturing an article for use in a high temperature, oxidative environment, comprising:
providing a substrate; and
disposing a protective layer over said substrate, said protective layer comprising at least about 60 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir, and mixtures thereof.

[c46] 46.The method of claim 45, further comprising disposing a top layer over said protective layer, said top layer comprising a thermal barrier layer.

[c47] 47.The method of claim 45, wherein disposing said thermal barrier layer comprises depositing said thermal barrier layer using at least one of ion plasma deposition, physical vapor deposition, high-velocity oxyfuel deposition, plasma spraying, and chemical vapor deposition.

[c48] 48.The method of claim 45, wherein disposing said thermal barrier layer comprises disposing a ceramic.

[c49] 49.The method of claim 48, wherein disposing said ceramic comprises disposing yttria-stabilized zirconia.

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- [c50] 50.The method of claim 46, further comprising disposing a diffusion barrier layer over said substrate, wherein said diffusion barrier layer is interposed between said substrate and said protective layer.
- [c51] 51.The method of claim 50, wherein disposing said diffusion barrier layer comprises depositing said layer using at least one of ion plasma deposition, physical vapor deposition, high-velocity oxyfuel deposition, plasma spraying, chemical vapor deposition, and electroplating.
- [c52] 52.The method of claim 50, wherein disposing said diffusion barrier layer comprises disposing material comprising ruthenium.
- [c53] 53.The method of claim 45, further comprising disposing a diffusion barrier layer over said substrate, wherein said diffusion barrier layer is interposed between said substrate and said protective layer.
- [c54] 54.The method of claim 53, wherein disposing said diffusion barrier layer comprises depositing said layer using at least one of ion plasma deposition, physical vapor deposition, high-velocity oxyfuel deposition, plasma spraying, chemical vapor deposition, and electroplating.
- [c55] 55.The method of claim 53, wherein disposing said diffusion barrier layer comprises disposing material comprising ruthenium.
- [c56] 56.The method of claim 45, wherein providing said substrate comprises providing a superalloy, said superalloy comprising one of a cobalt-based alloy, a nickel-based alloy, and an iron-based alloy.
- [c57] 57.The method of claim 45, wherein providing said substrate comprises providing a component of a gas turbine assembly.
- [c58] 58.The method of claim 57, wherein said component comprises one of a turbine blade, a vane, and a combustor component.
- [c59] 59.The method of claim 45, wherein disposing said protective layer comprises depositing said protective layer using at least one of ion plasma deposition, physical vapor deposition, high-velocity oxyfuel deposition, plasma spraying,

chemical vapor deposition, and electroplating.

- [c60] 60.The method of claim ~~45~~, wherein said protective layer comprises at least about 85 atomic percent of said at least one metal.
- [c61] 61.A method for manufacturing a component for a gas turbine assembly, comprising:
providing a substrate selected from the group consisting of a turbine blade, a vane, and a combustor component;
disposing a diffusion barrier layer comprising ruthenium over said substrate;
disposing a protective layer over said diffusion barrier layer, said protective layer comprising at least about 60 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir, and mixtures thereof; and
disposing a thermal barrier layer comprising yttria-stabilized zirconia over said protective layer.
- [c62] 62.A method for manufacturing a component for a gas turbine assembly, comprising:
providing a substrate selected from the group consisting of a turbine blade, a vane, and a combustor component;
disposing a protective layer over substrate, said protective layer comprising at least about 60 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir, and mixtures thereof; and
disposing a thermal barrier coating comprising yttria-stabilized zirconia over said protective layer.
- [c63] 63.An article for use in a high temperature, oxidative environment, comprising:
a substrate comprising at least about 60 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir, and mixtures thereof; and
a thermal barrier layer disposed over said substrate.
- [c64] 64.The article of claim ~~63~~, wherein said thermal barrier layer comprises a ceramic.
- [c65] 65.The article of claim ~~64~~, wherein said ceramic comprises yttria-stabilized zirconia.

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[c66] 66.The article of claim ~~63~~, wherein said thermal barrier layer has a thickness in the range from about 50 microns to about 500 microns.

[c67] 67.The article of claim ~~66~~, wherein said thickness is in the range from about 100 to about 250 microns.

[c68] 68.The article of claim 63, wherein said substrate comprises at least about 85 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir, and mixtures thereof.

[c69] 69.The article of claim 63, wherein said substrate comprises a gas turbine assembly component.

[c70] 70.The article of claim ~~69~~, wherein said component comprises one of a turbine blade, a vane, and a combustor component.

[c71] 71.A component for a gas turbine assembly, comprising:
a substrate comprising one of a turbine blade, a vane, and a combustor component, wherein said substrate comprises at least about 60 atomic percent of a metal selected from the group consisting of Pt, Pd, Rh, Os, Ir, and mixtures thereof; and
a thermal barrier layer disposed over said substrate, said layer comprising yttria-stabilized zirconia.

[c72]